



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/537,200	06/02/2005	Koichi Shimizu	1433(05-28)	1875

30030 7590 10/31/2007

JAMES R. WILLIAMS
3103 WILMINGTON ROAD
NEW CASTLE, PA 16105

EXAMINER

LANGMAN, JONATHAN C

ART UNIT	PAPER NUMBER
----------	--------------

1794

MAIL DATE	DELIVERY MODE
-----------	---------------

10/31/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/537,200	Applicant(s) SHIMIZU ET AL.	
	Examiner Jonathan C. Langman	Art Unit 1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 August 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hide et al., "Mould shaping silicon crystal growth with a mould coating material by the spinning method" J. Crystal Growth in view of Woditsch et al. (U.S. 4,755,220).

Regarding claims 1 and 2, Hide et al. teach a coating that acts as a release agent. The coating lines a crucible for holding silicon and is made up of silicon nitride mixed with silicon dioxide (Hide et al., pg. 585, col. 1). Hide et al. goes on to teach that the ratio of silicon oxide and silicon nitride may be adjusted for desirable results (Hide et al., pg. 585, col. 2). However, Hide et al. is silent to the exact ratio of the mixture and furthermore does not suggest elemental silicon is a part of the mixture.

Woditsch et al. teach a crucible made up of a composite of silicon nitride, silicon oxide, elemental silicon, and silicon oxynitride (Woditsch et al., col. 2, lines 16-20). The specific ratios for **metal silicon (X): silicon nitride (Y): silicon oxide (Z): silicon oxynitride (Q)** are **X:Y:Z:Q = 2-20: 40-90: 2-20: 2-20** (Woditsch et al., col. 2, lines 50-55) (emphasis added). These ranges overlap with the instantly claimed ranges, and the claim language of the instant claim is open ended due to the word "comprising" therefore this specific composition reads on the applicants instantly claimed invention

even with the addition of silicon oxynitride. Woditsch et al. and the claims differ in that Woditsch et al. does not teach the exact same proportions as recited in the instant claims. However, one of ordinary skill in the art at the time the invention was made would have considered the invention to have been obvious because the compositional proportions taught by Woditsch et al. overlap the instantly claimed proportions and therefore are considered to establish a prima facie case of obviousness. It would have been obvious to one of ordinary skill in the art to select any portion of the disclosed ranges including the instantly claimed ranges from the ranges disclosed in the prior art reference, particularly in view of the fact that;

“The normal desire of scientists or artisans to improve upon what is already generally known provides the motivation to determine where in a disclosed set of percentage ranges is the optimum combination of percentages”, In re Peterson 65 USPQ2d 1379 (CAFC 2003).

Also, In re Geisler 43 USPQ2d 1365 (Fed. Cir. 1997); In re Woodruff, 16 USPQ2d 1934 (CCPA 1976); In re Malagari, 182 USPQ 549, 553 (CCPA 1974) and MPEP 2144.05.

Woditsch et al. teach that the novel composite material makes up the crucible instead of teaching the composition as a coating on a crucible. However the material of Woditsch et al. is used and shows great results as a material for dewetting the surface of an inner wall of a crucible. The silicon melt is unable to cling on to the walls of the crucible due to the novel composition.

Hide et al. instead of teaching the entire crucible made up of this dewetting composition, teach, for economical purposes, that only lining a crucible will suffice and therefore less amounts of the novel composition are is needed. Hide et al. teach compositions of similar materials to those taught by Woditsch et al can be used as liners

Art Unit: 1794

for crucibles. It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use the novel composition of Woditsch et al. as a liner for a crucible as taught by Hide et al., because the materials have been shown to be functional equivalents and furthermore, as stated above for economical reasons.

Regarding claims 3, 4, and 7-9, Hide et al. and Woditsch et al. teach coating a crucible with a composition as described above. The crucible as taught by Hide et al. is made up of Graphite (Hide et al., pg. 588, col. 2). However it would have been obvious to a person having ordinary skill in the art at the time the present invention was made to make the mould of any known material in the art for silicon processing, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious engineering choice. (*In re Leshin*, 125, USPQ 416).

Regarding claims 5 and 10, Hide et al. teach that the coating is around 200 microns thick (Hide et al., Figure 1). This falls within both of the given ranges in the instant claims. It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to choose a thickness large enough to provide optimal protection to the outer crucible, and to provide good dewetting properties to the crucible. It would have been obvious to one having ordinary skill in the art at the time of the invention to adjust the thickness of the coating for the intended application, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding claim 6, Hide et al. and Woditsch et al. teach a coating for a crucible as described above. They do not teach in combination the exact same process limitations as set out in the instant claim. Barring any unexpected results, it would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use any commonly well known coating technique, including spraying.

In further regards to claims 1 and 6, Hide et al. and Woditsch et al. teach a coating for a crucible used in silicon melting, as described above.

Regarding the amount of silicon oxide used in the composition of Woditsch et al., they teach, "It is known that silicon dioxide reacts with liquid silicon to form volatile silicon monoxide. On the other hand silicon dioxide is poorly wetted by a silicon melt whereas silicon nitride is wetted relatively well" (Woditsch et al., col. 2, lines 40-45). It would have been obvious to a person having ordinary skill in the art at the time the present invention was made, barring unexpected results, to optimize the ratio of silicon oxide in the composition: enough to make sure proper dewetting occurred and not too much to cause degradation of the layer to silicon monoxide. Since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Regarding the amount of elemental silicon in the material, Woditsch et al. teach, "If the material is to be used at temperatures below 1400°C it can be useful for economic reasons to produce (the composition) having a high content of free elemental silicon by applying short nitriding times" (Woditsch et al., col. 5, lines 48-55). It would

have been obvious to a person having ordinary skill in the art at the time the present invention was made to optimize the amount of silicon metal used in the composition in order to achieve a more cost effective composition, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Response to Arguments

Applicant's arguments filed August 10, 2007 have been fully considered but they are not persuasive.

I. The applicants argue^s that the prior art references cannot be combined to obviate the invention. The applicants state that the Examiner has combined a coating material with a crucible material and that the Examiner has not provided a reason that would have prompted a person of ordinary skill in the art to combine the elements. The Examiner points the Applicant to the non-final office rejection where it was stated:

"Woditsch et al. teach that the novel composite material makes up the crucible instead of teaching the composition as a coating on a crucible. However the material of Woditsch et al. is used and shows great results as a material for dewetting the surface of an inner wall of a crucible. The silicon melt is unable to cling on to the walls of the crucible due to the novel composition.

Hide et al. instead of teaching the entire crucible made up of this dewetting composition, teach, for economical purposes, that only lining a crucible will suffice and therefore less amounts of the novel composition are needed.

Hide et al. teach compositions of similar materials to those taught by Woditsch et al. can be used as liners for crucibles. It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to use the novel composition of Woditsch et al. as a liner for a crucible as taught by Hide et al., because the materials have been shown to be functional equivalents and furthermore, as stated above for economical reasons".

Thus showing a reason to combine Woditsch et al with Hide et al.

II. Silicon as a Binder Material

The applicant argues that the prior art references teaches silicon dioxide suspension as a binder and not using silicon metal as the binder material as is done in the instant invention.

- If this were true, the limitation of silicon metal acting as a binder is introduced at claim 2, so the rejection of claims 1 and 3-9 would still be deemed proper in view of the prior art of record.
- Furthermore, using silicon metal as a binder is intended use, as long as the silicon metal is present, which it is, it can be said to read on the limitations as set forth in a structural invention.
- Even Furthermore, the prior art of record teaches that the composition includes silicon metal and therefore it can be assumed that performs some bonding.

20% Silicon Metal

The applicants argue that Woditsch does not describe a composition with more than 20 wt. % silicon metal, and that in contrast the present invention describes a binder of at least 20 wt % silicon metal.

- This is not the case, because the composition as claimed states that silicon metal is 20-50 wt%, which includes 20 Wt%, therefore, when Woditsch et al. teaches 2-20 wt% silicon metal within the composition, this reads upon the claims as instantly claimed.
- Furthermore, Woditsch et al. teach that each component of the composition may exist in an amount of up to 95% by weight. (Woditsch et al. col. 2, line 30 and claim 2).
- Furthermore, Woditsch et al. teaches that higher amounts of silicon metal may be used. It would have been obvious to adjust the amount of silicon metal for the desired application into ranges higher than 20 wt%, for economical reasons; the Applicant is directed to the Non Final office action where it states:

“Regarding the amount of elemental silicon in the material, Woditsch et al. teach, “If the material is to be used at temperatures below 1400°C it can be useful for economic reasons to produce (the composition) having a high content of free elemental silicon by applying short nitriding times” (Woditsch et al., col. 5, lines 48-55). It would have been obvious to a person having ordinary skill in the art at the time the present invention was made to optimize the amount of silicon metal used

in the composition in order to achieve a more cost effective composition, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980)".

"Thermet"

The applicant argues that neither reference is a thermet. The applicant has defined thermet in the Remarks filed on August 10th as "a thermally treated ceramic/metal composite where silicon metal is the binder for silicon nitride ceramic".

First off the applicant has not claimed a thermet composition

Furthermore, even if the applicant amends the claims to read "a thermet", the definition as stated above for a thermet can not be found in the instant specification. Therefore, the Examiner relies upon the definition of a thermet as is well known in the art, to be a thermally treated ceramic metal composite. Woditsch et al. teach a composite comprising silicon dioxide, silicon metal and silicon nitride, that is thermally treated. Therefore, it is said that Woditsch et al. teach a composition that is a thermet material.

Summary

It is well known in the art and much research has gone into Silicon Nitride coatings of quartz, graphite and boron nitride crucibles for the release of silicon melts. Silicon nitride coatings on crucible walls have been well known and are evident in US patents 4,090,851 and is further mentioned by Woditsch et al. (col. 1, lines 38-45).

Woditsch et al. teach a novel composition for an entire vessel, which comprises and overlaps the same composition as claimed in the instant application. Woditsch et al. make the entire crucible out of this novel composition in order to reuse the crucible several times. For cost reduction one of ordinary skill in the art would apply the novel composition of Woditsch et al., as a coating to the outside of a quartz crucible as is known in the art. Woditsch et al. as discussed in the prior Non-Final office action correlates the amounts of silicon oxide, silicon nitride, and silicon metal to be used in the composition. Silicon oxide used for dewetting, silicon nitride used for improving corrosion wear, and silicon metal for cost reduction. This novel composition teaches enhanced benefits to the coatings of crucibles for the release of melts therefrom.

For the reasons stated above, the previously made rejections are maintained, the Applicant has not persuasively argued nor amended the claims to put them in condition for allowance. The action is therefore made FINAL.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

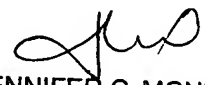
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan C. Langman whose telephone number is 571-272-4811. The examiner can normally be reached on Mon-Fri 9:00 am - 4:30 pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer McNeil can be reached on 571-272-1540. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JCL




JENNIFER C. MCNEIL
SUPERVISORY PATENT EXAMINER
10/25/17